

2010 ANNUAL REPORT TO THE ADMINISTRATOR



NASA INVENTIONS AND
CONTRIBUTIONS BOARD

Launching Innovation

The background is a solid gold color. There are several overlapping circles of varying sizes, drawn with thin white lines. One large circle is in the bottom right, partially cut off. Another large circle is in the middle left. A smaller circle is in the top right. There are also some smaller circles overlapping the larger ones, creating a complex geometric pattern.

ON THE COVER:

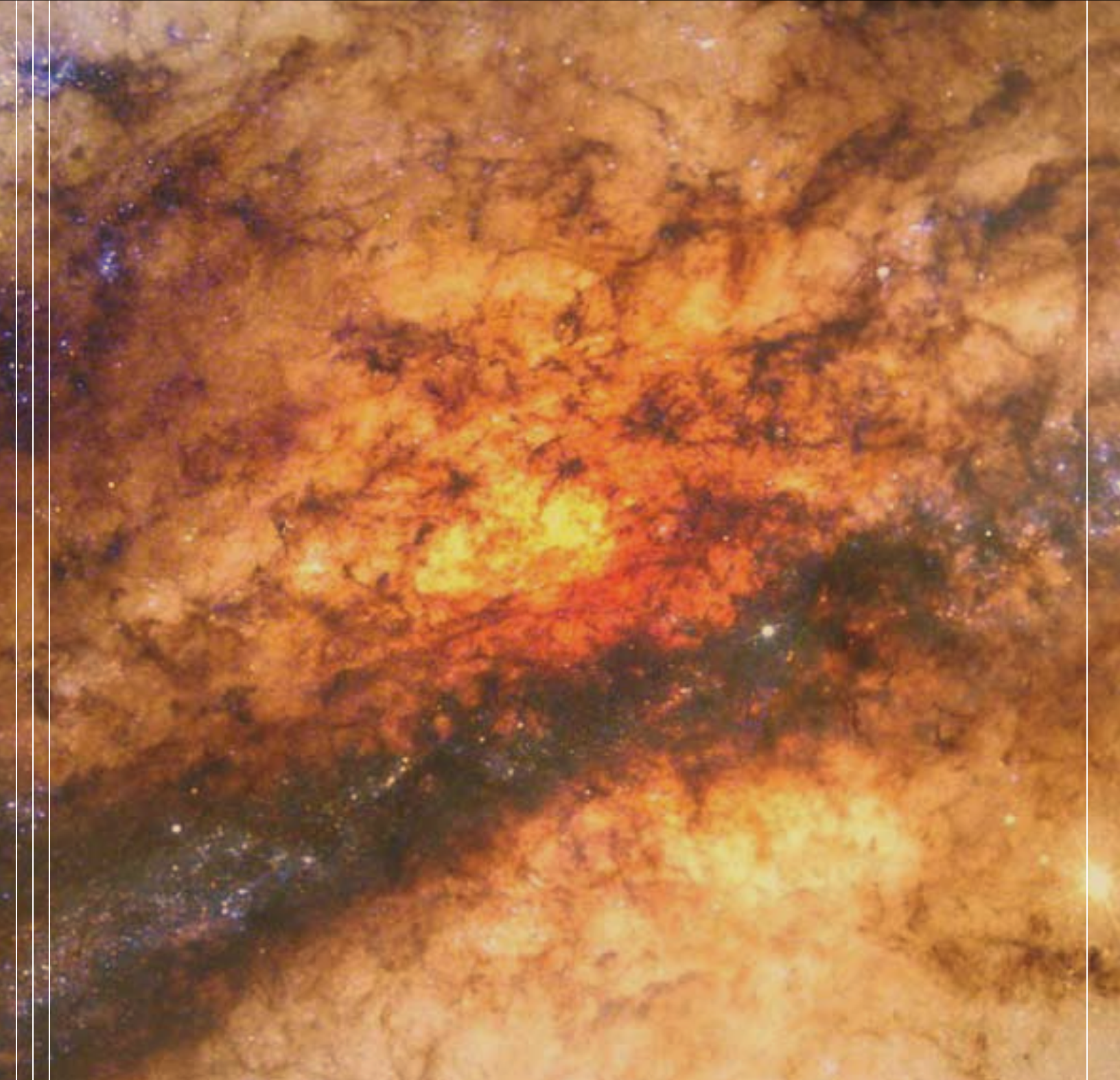
Space Shuttle Atlantis takes flight on its STS-27 mission on December 2, 1988, 9:30 a.m. EST, utilizing 375,000 pounds of thrust produced by its three main engines. The STS-27 was the third classified mission dedicated to the Department of Defense (DoD).

Credit: NASA and Ball Aerospace

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MESSAGE FROM
THE CHAIR

Foreword





Mike Ryschewitsch welcomes Space Shuttle Atlantis crew member and Hubble Space Telescope repairman exemplar John Grunsfield and the other six STS-125 crew members back to Earth after a successful mission. The landing at 10:39 a.m. CDT on May 29, 2009, at Edwards Air Force Base in California, capped off a nearly 13-day groundbreaking mission to repair and upgrade Hubble.

Message from the Chair

Welcome to the 2010 Inventions and Contributions Board Annual Report, where the best inventions in the Agency get their day in the sun. Each National Aeronautics and Space Administration (NASA) sponsored invention starts as an idea, but through the hard work and intellect of our inventors gets pushed ahead into reality with a vigor akin to rocket thrust. While the worth of monumental inventions is plainly evident to the general public, in other cases the knowledge and expertise of the Inventions and Contributions Board (ICB) is utilized to understand and recognize the significance of more esoteric and incremental advances. Because all these advances, monumental or esoteric, are required to move science and technology forward, the ICB strives to bring them all forward for recognition. As this wave of scientific advancement simultaneously rushes

and creeps steadfastly on, new knowledge and achievements become possible. It is NASA's mission to help the Nation and humanity unite in the joyous pursuit of the understanding of our surrounding universe. The intent of this annual report is to encourage all inspired by this pursuit to continue their collective efforts and to know that they are and will continue to be appreciated for their contributions in revealing what the future holds. The Office of the Chief Technologist (OCT) provides the strategic view of NASA's technology needs to its inventors and industry partners. The Office of the Chief Engineer (OCE) then works to enable the tactical and logistic support for our engineers and scientists. With this cooperation, the Agency has won and can expect many technical victories. Please join us in the recognition of these examples of NASA's finest technological achievements over the last twelve months.

Dr. Michael G. Ryschewitsch, Chair
NASA CHIEF ENGINEER

THE ICB MISSION

Introduction

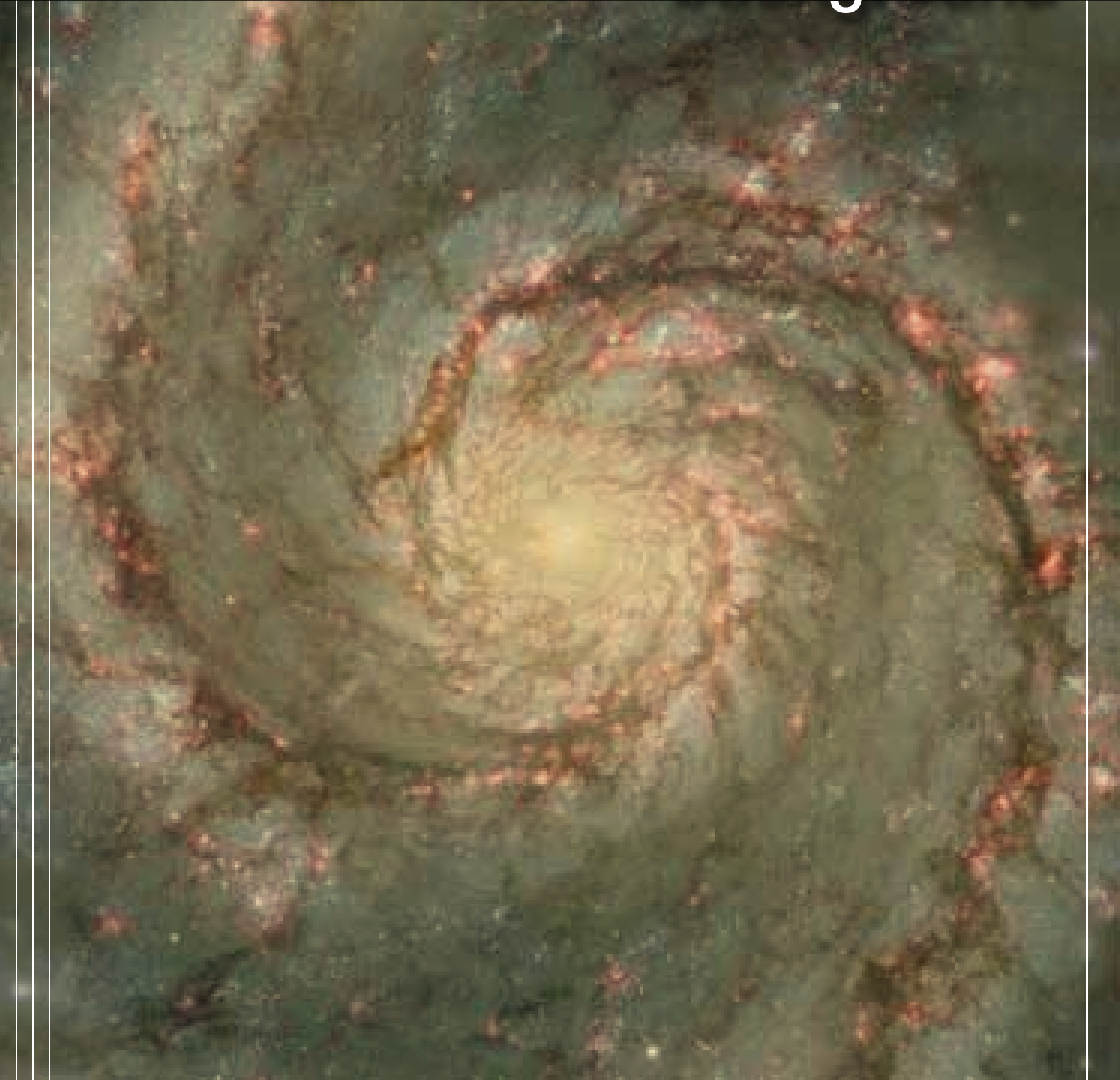


The ICB Mission

The ICB is comprised of technical specialists individually nominated by their home Center and appointed by the Administrator to provide the diverse expertise needed to evaluate new and unique technologies from NASA and its industry partners. ICB is authorized to approve awards up to \$100,000 without congressional notification. With the help of its staff and legal counsel, the ICB reviews and evaluates contributions to the Government and the Nation. Many of these inventions and contributions will help humanity explore the universe and improve life here on Earth. The ICB approved more than 3,319 individual cash awards totaling nearly \$1.8 million this year.

WHERE THE ICB
COMES IN

Background

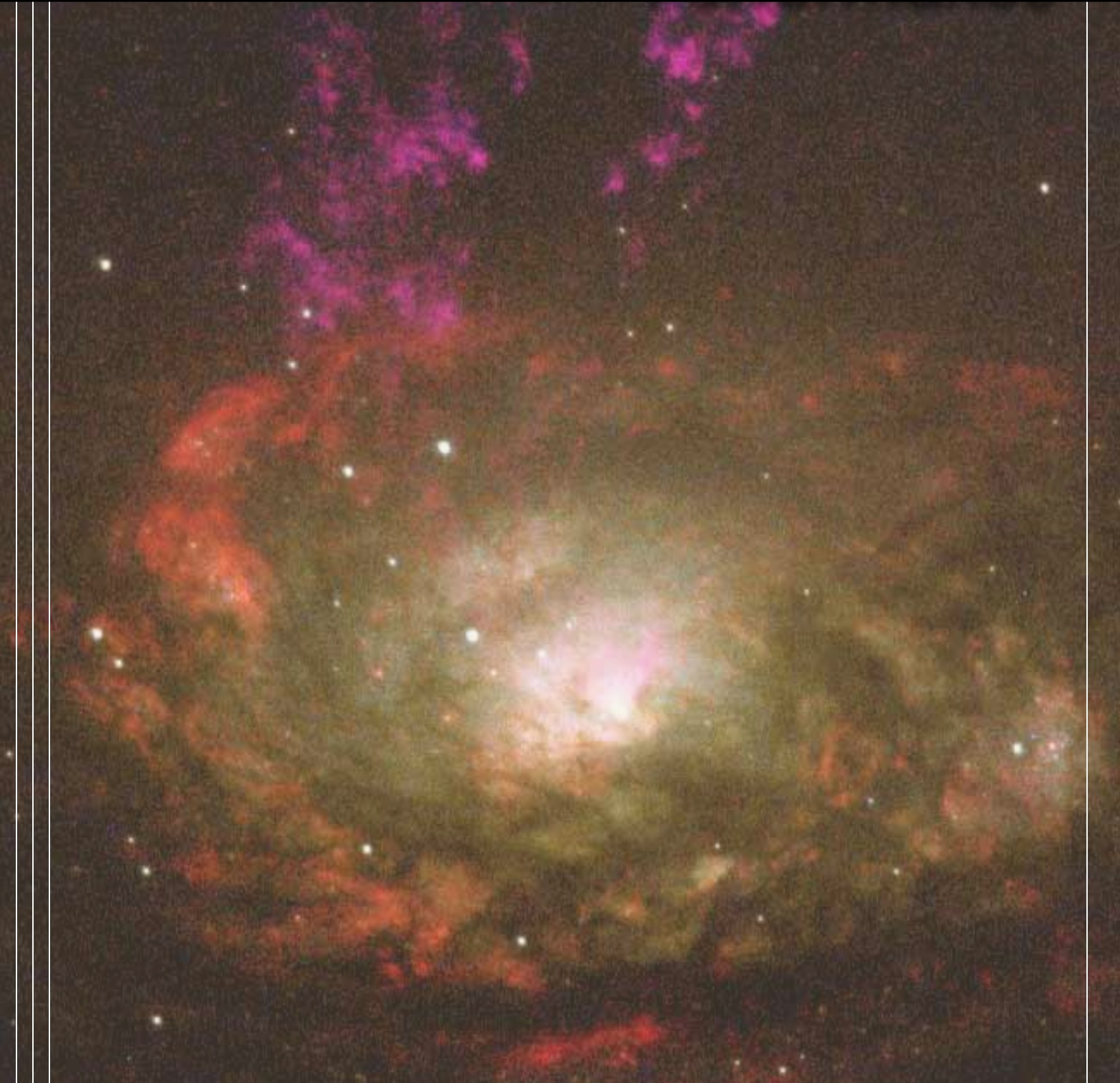


Where the ICB Comes In

Since the passage of the Space Act of 1958, which created NASA from its forerunner, the National Advisory Committee of Aeronautics (NACA), the ICB has been carrying out its task of recognizing NASA-sponsored scientific and technical aerospace innovation. It has presented an estimated 150,000 awards to NASA-sponsored inventors for their contributions to the Nation's advancement of science, flight, and space exploration. Information on awards from previous years is archived online at http://www.nasa.gov/offices/oce/icb/Annual_Report.html. The ICB conducts a competition to assist the OCE and the Office of the General Counsel (OGC) in the selection of up to two inventions to be named as Invention of the Year (IOY). A winner can potentially be named for each Government and/or Commercial categories. The ICB has also appointed a special panel of software experts to conduct the Software of the Year (SOY) competition and identify NASA's best software. For more information, see <http://www.nasa.gov/offices/oce/icb/Yearly-Comps.html>.

2010 AWARDS
STATISTICS AND METRICS

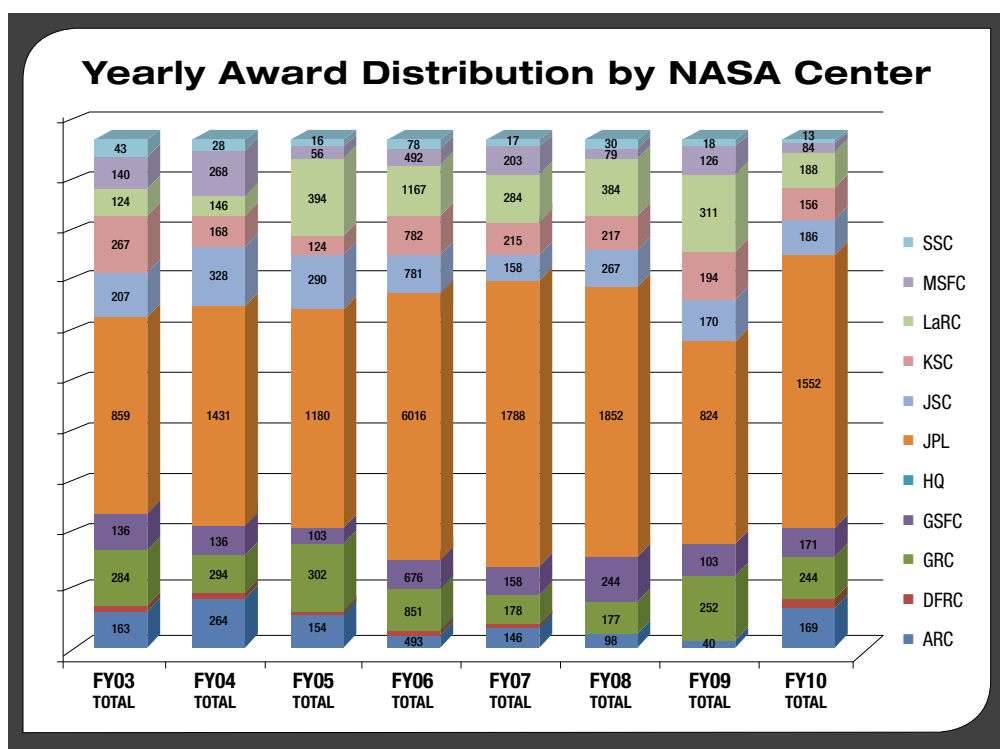
Performance



The Invention Awards Program continues to enjoy strong participation across NASA. The number of inventors approved for various award types illustrates the level of activity:

1. 512 individual Board Action awards were reviewed and approved in six meetings.
2. 554 patent applicants were awarded.
3. 683 software authors were awarded.
4. 1,570 NASA *Tech Briefs* authors were awarded.
5. There were four Exceptional cases—inventions with at least one inventor who was approved for an award of \$5,000 or more.

The awards program participation levels at each Center vary year to year as the chart below shows.



Exceptional ICB Award Cases



ICB award applications that result in at least one awardee receiving \$5,000 or more are classified as Exceptional awards. These awards must go to the NASA Administrator for approval. Descriptions of the Exceptional Board cases for 2010 follow. Each Technology is identified by a unique tracking code that consists of a three-letter code designating the lead NASA Center for its development and a five-digit number assigned to it at the time it was reported to NASA.

The Lead NASA Center Code Definitions are:

- Ames Research Center: ARC
- Dryden Flight Research Center: DFRC
- Glenn Research Center: GRC or LEW (formerly Lewis Research Center)
- Goddard Space Flight Center: GSC or GSFC
- Kennedy Space Center: KSC
- Langley Research Center: LaRC or LAR
- Jet Propulsion Laboratory: JPL
- Johnson Space Center: JSC
- Marshall Space Flight Center: MSFC
- Stennis Space Center: SSC
- Headquarters: HQ

Yearly Competitions

2009 Invention of the Year

The OGC is the organizational sponsor of the IOY awards competition. The competition year is the year before the selection is made, so in 2010, the 2009 IOY competition was held. An IOY award may be presented in two categories: (1) the NASA Commercial Invention of the Year, and (2) the NASA Government Invention of the Year.

The IOY awards are tied to the NASA invention patenting program, and while the ICB recommends winners, the OGC makes the final determination. Each nominated patent or suite of patents must have at least one NASA employee on it. Each Center may submit a maximum of two nominations, both of which are considered for each award. The ICB may elect not to recommend awards for either or both categories if they feel there is not a suitable nomination, and also may recommend the awards for both categories go to one nomination.

The eligibility requirements for the NASA Commercial Invention of the Year award are linked to the National Inventor of the Year event promoted by the Intellectual Property Owners Educational Foundation (IPOEF), which the Commercial Invention of the Year may be nominated to if one is selected. Only inventions that were commercialized to non-Government customers during the last four years (2006-2009) can be considered. The ICB and the OGC did not select a Commercial Invention of the Year for 2009, but did select a Government Invention of the Year.

The eligibility requirements for the NASA Government Invention of the Year are based on the impact the nominated inventions have had on NASA's mission and in other Government programs. While commercial sales may exist, the deciding factor for the Government Invention of the Year Award is the value to Government uses.



The Ultrasonic Wire Crimp Inspection Technology tool enables field workers to verify each crimp meets acceptable standards as it is made.

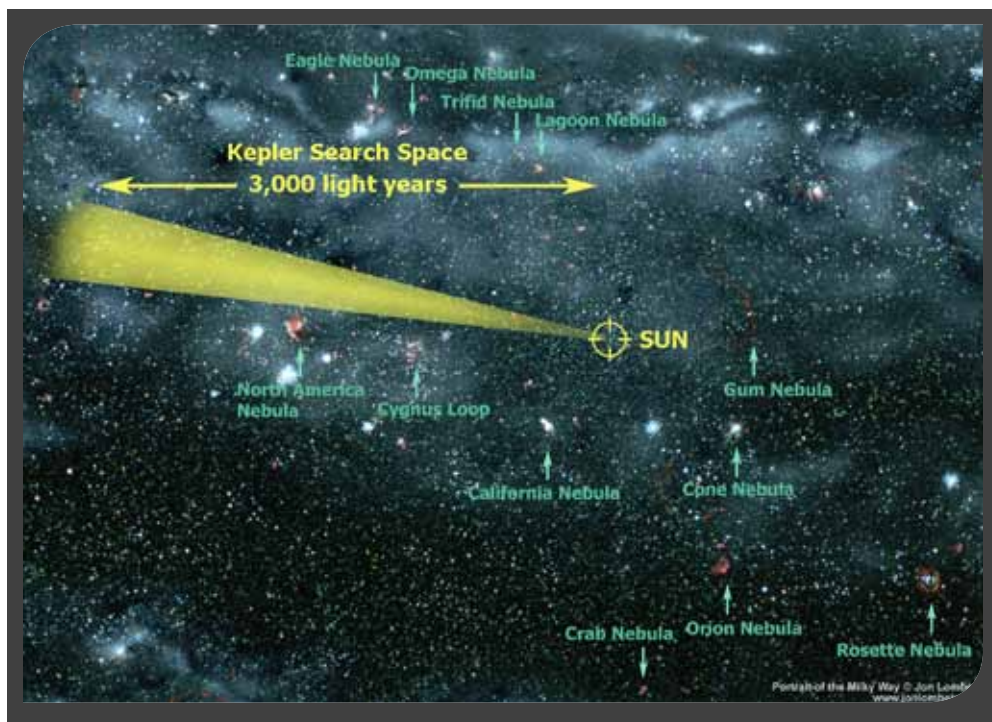
The NASA Government Invention of the Year Award for 2009 was conferred upon LAR-16575: The Ultrasonic Wire Crimp Inspection Technology.

This invention uses ultrasonic wave transmission through ferrule-wire joints (perpendicular to the geometric axis of the joint) to nondestructively inspect mechanically crimped electrical connections for internal defects. It is much more informative than pull testing samples, which is the current standard. It can be applied to many different crimping operations, especially critical connections such as those on flight vehicles. Due to the huge number of crimped connections on military and civilian aircraft, there is interest in making this technique a requirement for all critical aviation system electrical

crimps. This technique stands to have a huge impact in all technical areas due to the huge number of crimped connections in many electrical systems in fields of application outside of aviation. This technology is currently being used as part of the Aircraft Aging and Durability Project to investigate failure of electrical wiring systems in aircraft. Currently the technology is being evaluated by the Federal Aviation Administration (FAA), Naval Air Systems Command (NAVAIR), and the Coast Guard for potential application to commercial and military flight systems.

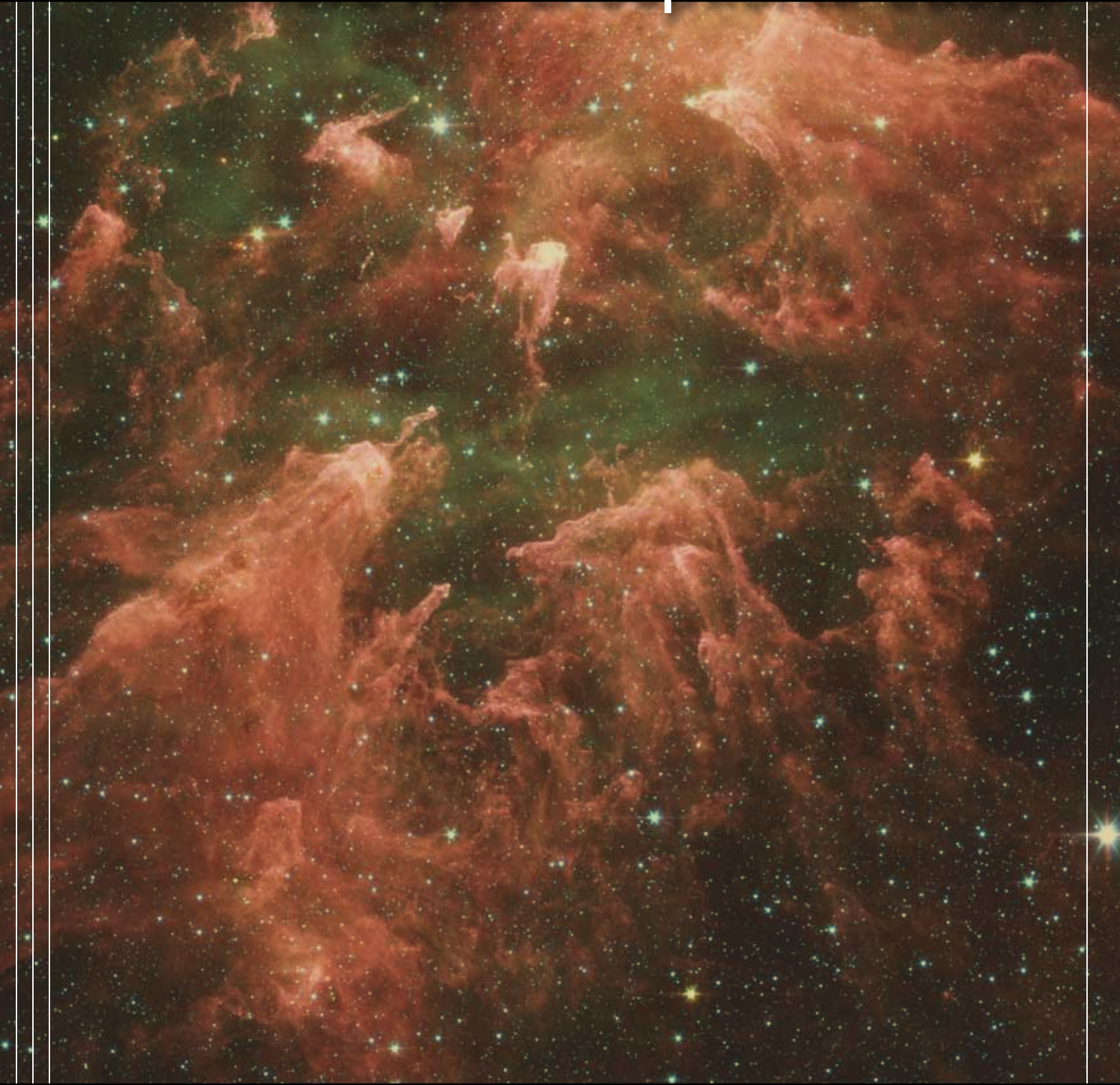
2010 Software of the Year (SOY) Competition

The 2010 SOY Winner is ARC-16332-1: Kepler Science Operations Center (SOC) SCIENCE Pipeline (Release 6.0). This contribution is designed to support transit photometry on 165,000 stars simultaneously in the search for Earth-like planets 3,000 light years away. To identify an Earth-like planet as it crosses between Earth and its distant home star, the system must remove natural and instrumental effects from the data in order to bring out faint signals of the distant planets. It accomplishes this via custom algorithms, a high degree of software parallelism, scalability, and fast access to data from a distant spacecraft. The software must also account precisely for spacecraft temperature effects, drift, roll, and aberrations caused by the optics of the telescope itself. Dimming of light caused by starspots and each of the stars' intrinsic variabilities must also be removed. The system encompasses science data processing, system infrastructure, target management, photometer management, and commissioning tools. This functionality is distributed among twenty-plus software components.

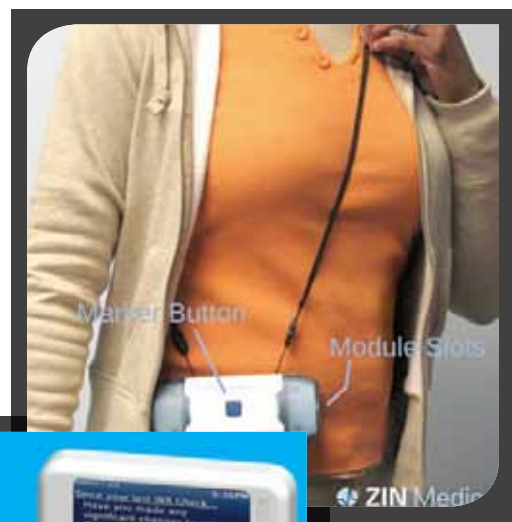


The Kepler Mission looks for Earth-like planets that may be able to support life by determining if they are in orbit about their sun at a distance similar to Earth's orbit. This area of livable temperatures where it is not too hot or cold is called the "Goldilocks Zone" since it is just right for human life.

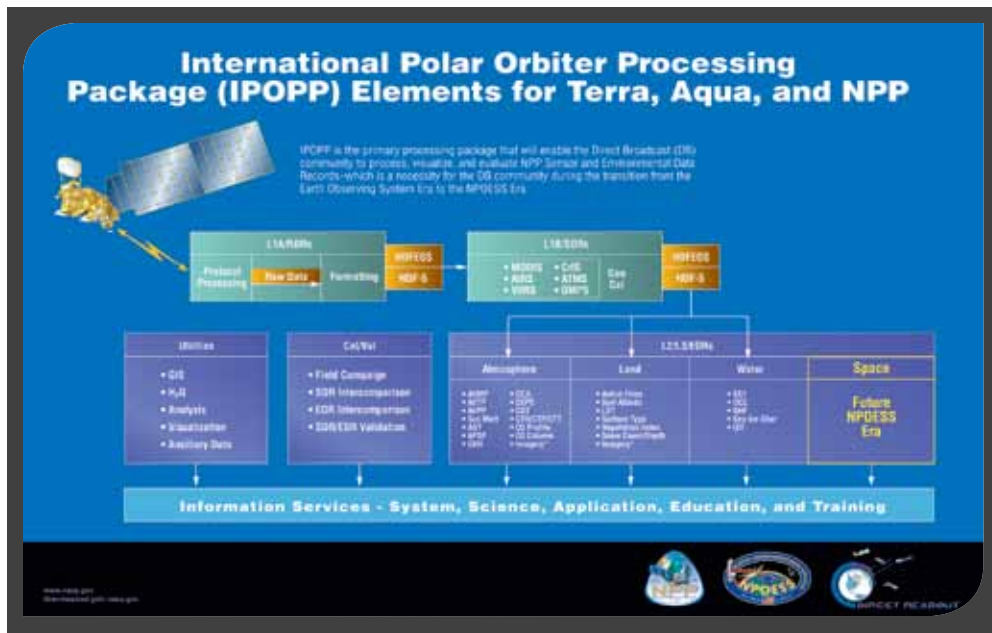
More ICB Exceptional Cases



The ICB regularly recognizes Exceptional contributions beyond those entered in the yearly competitions. An Exceptional award went to the technology suite LEW-18013, 118357, 18358: Compact Wireless Biometric Monitoring and Real Time Processing System (vMetrics). vMetrics is an ambulatory physiologic parameter monitoring platform. It is a modular, customizable system that provides clinicians, clinical research personnel, and home healthcare providers the ability to monitor patients remotely for long periods of time. It has module slots, which enable the user to configure the system to match specific needs by simply inserting sensor-specific cards. The data is then sent in real time from the unit over any commercially implemented wireless network including Ethernet, Bluetooth, cellular phone network, and wireless medical telemetry systems. Real-time remote monitoring may enable better quality of life, and reduce dependency on hospitalization for disease management. It may reduce hospitalization costs and enhance the quality of life by enabling patient mobility while enforcing patient compliance to treatment—all of which should yield better medical results.



The vMetrics system is wearable and wireless, enabling patients to be mobile as they are monitored by doctors remotely.

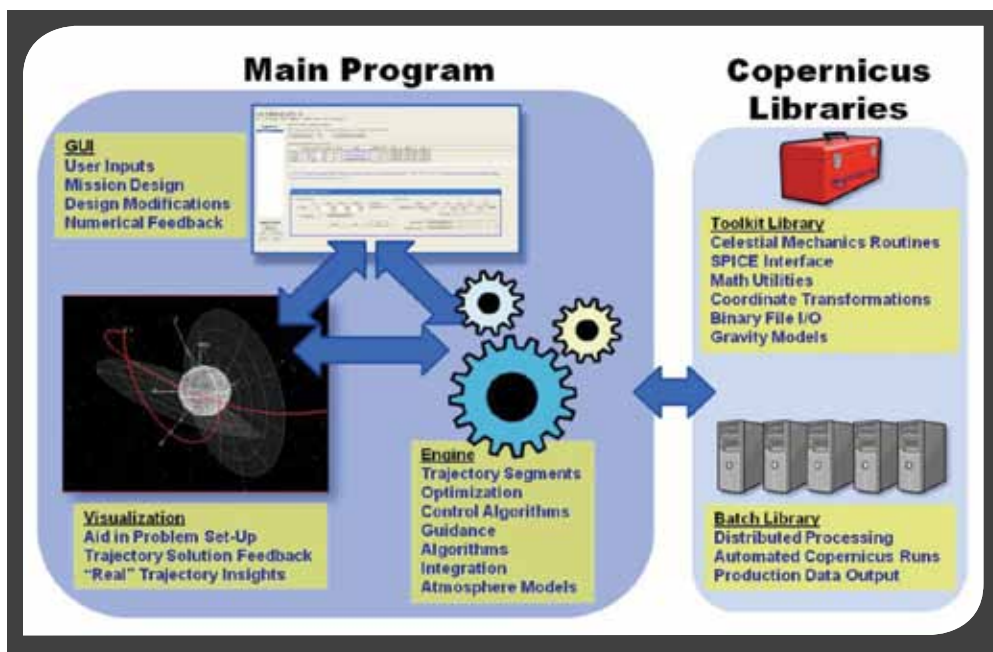


POPP enables the scientific community around the globe to receive and decode direct broadcasts of data from the Polar orbiter and other satellites.

GSC-15570-1, the International Polar Orbiter Processing Package (IPOPP), was recognized with an Exceptional award in 2010. This software package was GSFC's 2010 SOY nomination. It enables the processing, visualization, and evaluation of Earth science data from current and future satellite missions that freely transmit live data. It currently processes data from the Terra and Aqua missions, and will be used to process data from future National Polar Orbiter missions. It is composed of the Front End System (FES) to convert the telemetered data and the Data System (DS) to create and manage the data products. It then makes these data products available to at least 29 users in the U.S. military, Government agencies, and industry for real-time information on hazards such as fires, sand storms, and sea ice. It may save up to \$9 million per year for the next five years compared to alternate approaches.

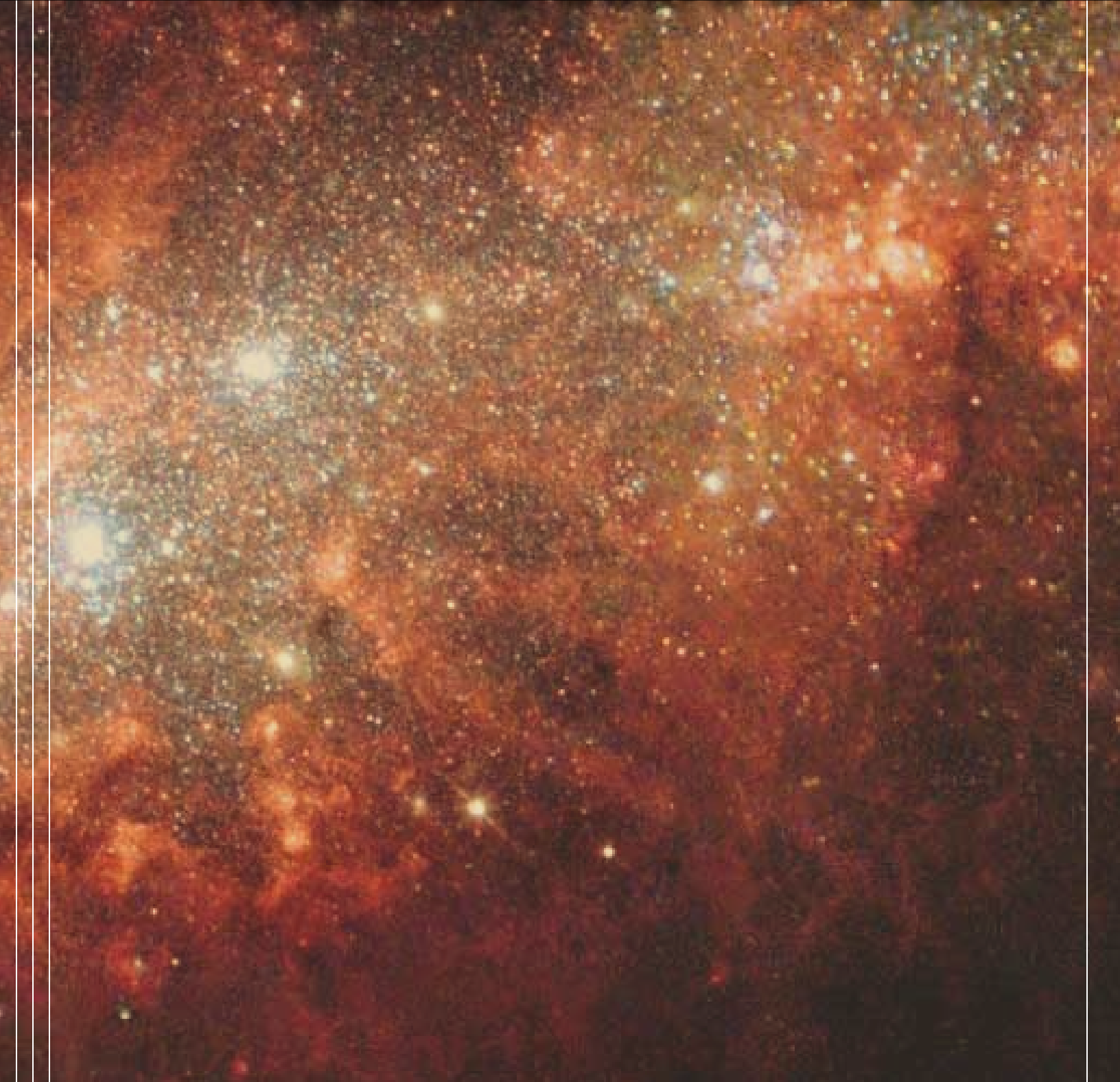
The JSC SOY nomination also achieved Exceptional award status in 2010. It is MSC-24209-1: Optimal Multi-Gravity, Multi-Spacecraft Trajectory Optimization and Design System, known as Copernicus. The Copernicus Trajectory Design and Optimization System (shown below) implements a comprehensive approach to performing mission design, trajectory analysis, and optimization. It integrates state-of-the-art algorithms in spacecraft state propagation, optimization, and interactive visualization, allowing the user to design spacecraft missions for nearly all possible

Solar System destinations. The system accommodates the use of many types of propulsion systems, any number of spacecraft, and any user-definable force field models. All of these features are accomplished within a single architecture via a comprehensive interface, or passively via external interfaces that execute batch processes. The Constellation Program and the Orion Project have identified Copernicus as a primary performance analysis tool. It has allowed engineers at JSC to quickly gain a deep understanding of how lunar mission design affects vehicle performance requirements. This knowledge has been instrumental in allowing JSC and other NASA Centers to meet a very demanding Orion development schedule. In addition, this tool has enabled a very small team of engineers to produce comprehensive analyses supporting selection of Orion propellant loading and tank sizing requirements, as well as selection of candidate Ares-V launch vehicles. Copernicus is being used to provide analysis and performance information in support of the Review of U.S. Human Space Flight Plans Committee (a.k.a. the Augustine Panel). Nonaerospace applications and uses involve the exploration and verification of algorithms to solve dynamical systems and algorithms to solve small- to large-scale optimization problems.



RECOGNIZING THE
INVENTORS

The 2010 Board and Staff



Recognizing the Inventors

The ICB for this year was made up of the following membership:

Dr. Michael G. Ryschkewitsch, Chair and NASA Chief Engineer

Dr. Donald C. Braun, GRC, Vice Chair

Ms. Helen M. Galus, Counsel to the Board, HQ

Mr. Robert F. Rotella, Counsel to the Board, HQ

Dr. G. Dickey Arndt, JSC

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Mr. Anthony (Tony) J. Maturo, Staff Director

Mr. Jesse C. Midgett, Chief Technologist

Ms. Iona Butler, Records Manager

Ms. Gail M. Sawyer, Staff Specialist

Ms. Angela F. Greene, Budget Assistant

The 2010 Software of the Year Advisory Panel: Augmenting the ICB

A special Software Advisory Panel hears presentations for the SOY competition and advises the ICB on the ranking of nominations. This panel consists of software experts from across NASA nominated by the NASA Centers to evaluate SOY nominations.



Left to right: John C. Kelly (HQ-OCE), Joseph Grant (SSC), Anthony J. Maturo (HQ-ICB), William L. Little (KSC), Roger A. Truax (DFRC), Felicia M. Wright (LaRC), Scott E. Green (GSFC), Lisa P. Montgomery (IV&V), James T. "Tom" Renfrow (JPL), Caroline K. Wang (MSFC), Lynn R. Vernon (JSC), Jay G. Horowitz (GRC), Jesse C. Midgett (HQ-ICB), Anthony R. Gross (ARC).

Not pictured: Lori Parker (HQ-OCIO), Martha Wetherholt (HQ-OCIO).

The 2010 Awards Liaison Officers: Priming the ICB Process

Centers also support the ICB by providing Awards Liaison Officers (ALO), patent counsels and attorneys, and technology transfer and software release authority personnel. The ALOs diligently submit their Centers' inventors for ICB consideration throughout the year. Please refer to the contact information below for information on the ICB award program at a specific NASA Center, as all ICB award submissions must go through a Center ALO.

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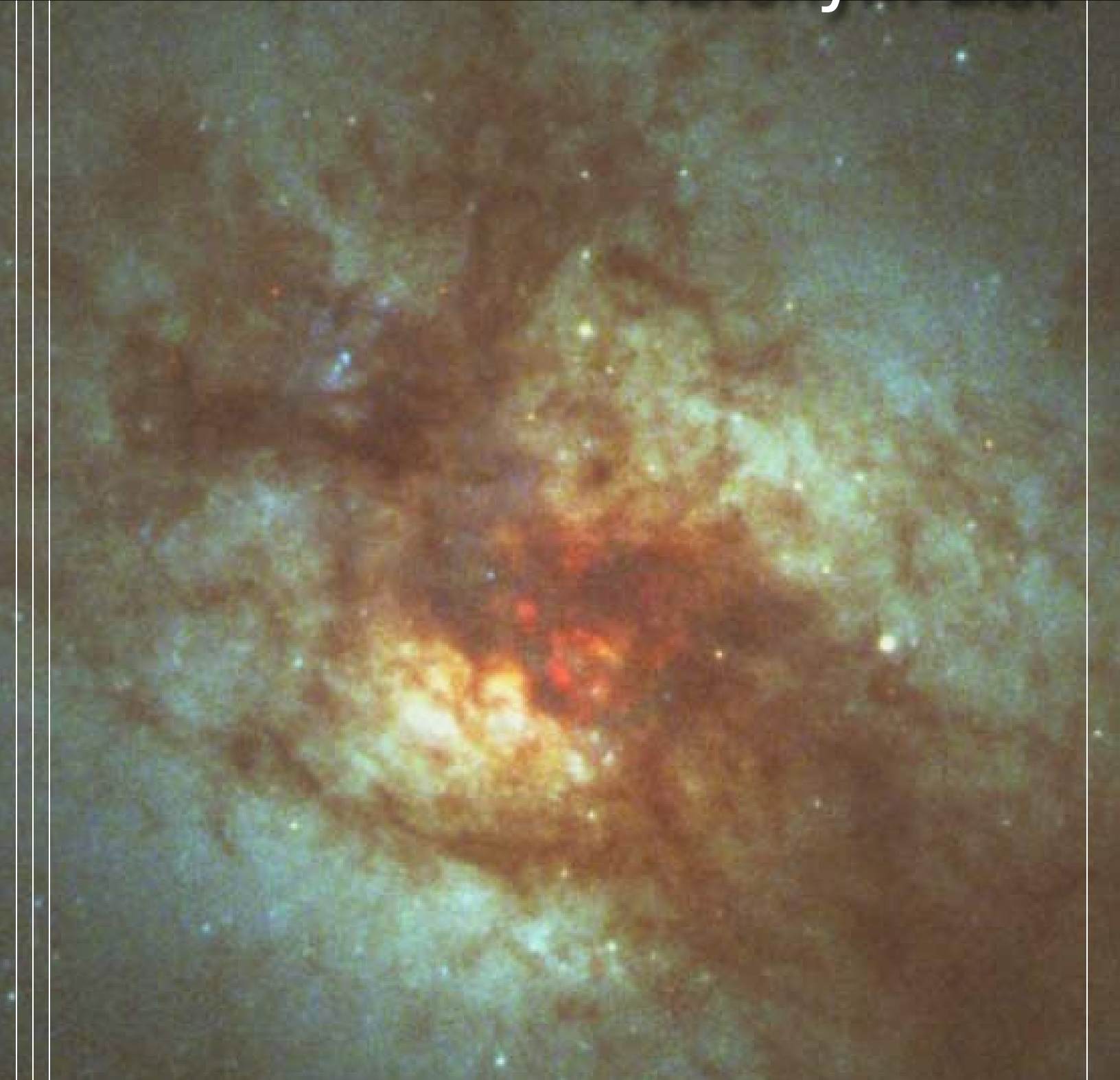
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Acronym List



2010 ICB Annual Report Acronym List

ARC	Ames Research Center
CDT	Central Daylight Time
DFRC	Dryden Flight Research Center
DS	Data System
FAA	Federal Aviation Administration
FES	Front End System
GRC	Glenn Research Center
GSC or GSFC	Goddard Space Flight Center
GUI	Graphical User Interface
HQ	NASA Headquarters
ICB	Inventions and Contributions Board
IOY	Invention of the Year
IPOEF	Intellectual Property Owners Educational Foundation
IPOPP	International Polar Orbiter Processing Package
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
KSC	Kennedy Space Center
LaRC or LAR	Langley Research Center
LEW	Glenn Research Center (formerly Lewis Research Center)
MSC	Johnson Space Center (formerly Manned Spaceflight Center)
MSFC	Marshall Space Flight Center
NACA	National Advisory Committee on Aeronautics
NASA	National Aeronautics and Space Administration
NAVAIR	Naval Air Systems Command
NDE	Nondestructive Evaluation
NESC	NASA Engineering and Safety Center
OCE	Office of the Chief Engineer
OCIO	Office of the Chief Information Officer
OCT	Office of Chief Technologist
OGC	Office of the General Counsel
SOC	Science Operations Center (IPOPP)
SOY	NASA Software of the Year
SPICE	Spacecraft, Planet, Instrument, Camera-matrix, and Events system
SSC	Stennis Space Center

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